SOLICITATION NO. NNG14490137R

NASA Sounding Rocket Operations Contract III
(NSROC III)

ENCLOSURE 1

TOP PROGRAM TECHNICAL CHALLENGES

~~**JUNE**~~ ~~**SEPTEMBER**~~**NOVEMBER 2014**

ENCLOSURE 1

TOP PROGRAM TECHNICAL CHALLENGES

1. **Background:** A major contributor to the decades of successful missions on the Sounding Rockets Program is the use of reliable propulsion systems. ~~Historically, the Government has acquired booster rocket motors or medium-performance sustainer motors from military surplus inventory. However, to achieve the higher altitude regimes of the Program's capabilities, commercially-available rocket motors have been procured. This was executed by the contractor during the NSROC I and NSROC II contracts, and this will remain a requirement during NSROC III.~~ In recent history, however, s~~S~~everal technical challenges have arisen with heritage ~~propulsion systems~~rocket motors ~~in recent years~~ that have added significant risk to the Program. These include, but are not limited to, combustion instability, residual thrust at the end of nominal burn-time, inconsistent thrust vs. time performance, excessive nozzle erosion during burn, and failure to ignite at high altitude (Additional information is included in the Procurement Library). The Program ~~requires reliable propulsion systems in order to ensure delivery of payloads to the required altitude regimes to maximize good science return~~must maintain a continuous operational pace in order to serve the science goals of the Agency, so interruptions in the launch manifest due to vehicle problems are intolerable.

   Challenge: In the event that heritage propulsion systems exhibit major technical performance anomalies (such as those listed above), or experience delayed or reduced availability, describe what methods will be employed to help the Program maintain progress in launching missions without compromising success criteria. The approach must remain consistent with NSRP risk posture and low cost access to space (LCAS) approach as described in Section 1.0 of the SOW. Consideration may be given to alternative propulsion units, launch sites, flight rules and launch windows (for missions that can tolerate a change in launch date without compromising science objectives). Also describe the approach to investigating and subsequently eliminating the technical anomalies or availability perturbations. This should include any design, analysis, and testing protocol that will be employed, as well as programmatic, contractual, procurement or logistical methods that will be used. ~~become unusable or otherwise unavailable, describe the process by which rocket motors will be obtained and introduced into the Program. Describe how the market will be evaluated to identify reliable and flight qualified, commercially available sustainers or upper-stage [exo-atmospheric] rocket motors that will meet the requirements of the mission model in Attachment A, SOW Table 3, per the relevant parts of Section 2.1.1.6 of the SOW. Describe the criteria by which the motors will be evaluated to determine how they will maintain and perhaps marginally increase the performance capabilities of the Program. Describe the technical challenges that need to be addressed when introducing a new rocket motor to the Program. Describe the criteria by which cost of the new rocket motor will be evaluated to be consistent with NSRP risk posture and low cost access to space (LCAS) approach as described in Section 1.0 of the SOW.Provide reliable and flight qualified, commercially available sustainer and upper-stage [exo-atmospheric] rocket motors to meet the requirements of the mission~~

~~model in Attachment A, SOW Table 3, per the relevant parts of Section 2.1.1.6 of the SOW. The motors must maintain and perhaps marginally increase the performance capabilities of the Program, and be low cost.~~

2. **Background:** Flight Termination Systems are required on sounding rockets that are predicted to fly higher than 110 km altitude at White Sands Missile Range. These systems may also be required on certain missions with tailored trajectories from other launch sites, such as Poker Flat Research Range. ~~Several technical challenges have arisen with heritage flight termination ordnance~~ systems in recent years that have added risk to the Program. These include, but are ~~not limited to, failed ordnance lot qualification testing, increased redundancy and test environment requirements from relevant safety organizations, parts obsolescence, and ordnance vendor quality control inconsistencies (Additional information is included in the Procurement Library).~~ The Program requires reliable Flight Termination ordnance components ~~Systems and components~~ to ensure public safety per very strict Range Commanders Council (RCC) requirements. These requirements make development and maintenance of flight termination ordnance components very labor intensive and expensive. The Program would benefit greatly from a flight termination ordnance design that is compatible with as many launch vehicle configurations as possible, thus reducing repeated development efforts and expenses, while allowing flexibility in launch vehicle selection.

   Challenge: ~~In the event that heritage flight termination ordnance system components become unusable or otherwise unavailable, describe the process by which these items will be obtained and introduced into the Program. Describe how the market will be evaluated to identify a long term flight termination ordnance system solution that is reliable, that minimizes damage to the payload subsequent to a termination event, and that maximizes the potential for usage on multiple vehicles. Describe the technical challenges that need to be addressed when introducing a new flight termination ordnance system to the Program. Describe the criteria by which cost of the new ordnance system design will be evaluated to be~~Describe the approach that will be employed in developing a common flight termination ordnance package for multiple sustainer and exo-atmospheric motors to be utilized at multiple launch sites. The design and testing must meet RCC requirements (an example of a tailored FTS requirements document for the Black Brant is in the procurement library) and remain consistent with NSRP risk posture and low cost access to space (LCAS) approach as described in Section 1.0 of the SOW.~~Provide a long term Flight Termination ordnance Ssystem design and ordnance solution that is reliable, that minimizes damage to the payload subsequent to a termination event, that maximizes the potential for usage on multiple vehicles, and that is low cost.~~ Include a detailed description of the purchase quantities and phasing, as well as programmatic, contractual, procurement or logistical efforts that will be necessary to ensure adequate inventory to support the Mission Model.

3. **Background:** The NASA Sounding Rockets Program has developed strong relationships with numerous members of the scientific and technology research communities both nationally and

globally. A major contributor to this has been close communication and collaboration with Principal Investigators and their team members on the technical aspects of their instrument design. Flight on a sounding rocket can be very dynamic and violent. The Program requires the appropriate balance between insight/oversight related to science instruments and enabling researchers to push the envelope of scientific discovery or technology development.

Challenge: To ensure reliability of science instruments consistent with the NSRP risk posture as described in Section 1.0 of the SOW, provide the appropriate level of oversight and insight into the design, analysis, and testing of the instrument to increase the likelihood of mission success, while not imposing excessive requirements, processes, and cost on the Principal Investigator and Program. Examples include, but are not limited to, requesting relevant design information from Principal Investigators for review, defining appropriate functional and environmental testing of science instruments, and offering the appropriate level of technical assistance to Principal Investigators and their teams who might be deficient in certain expertise areas.